**Training Session: 07/11/2017 Bolgatanga, Ghana**

**Soil water conservation, Tillage Methods, Rain water harvesting and Irrigation**

**Crop water requirements:** Crops take up water from the soil for dry matter (DM) production. The amount required for optimum production is about equal to the amount of evapo-transpiration (ETcrop) from the crop characteristics and local conditions including agricultural practices and irrigation. Therefore it is important to control losses of water and soil.

**Control of infiltration:** An increase in the infiltration rate of the soil allows the use of as much rainwater as possible to fill the soil reservoir thereby reducing runoff.

**Control of evaporation:** The non‐productive loss of water consists of evaporation from completely or partially bare soil surfaces and transpiration from weeds. Any control measures devised to reduce the rate of evaporation directly from the soil depend primarily on: modifying the atmospheric conditions existing at such a surface or reducing the amount of water retained near the surface when water is added to the soil

**Soil erosion:** Soil erosion is the wearing away of the soil surface by the action of raindrops, runoff and wind or animal traction.

**Forms of water erosion**

**Methods** **of** **erosion** **control**

**Agronomic or biological measures** use the role of vegetation in helping to minimize erosion.

They include:

 Shifting cultivation

 Agroforestry

 Crop rotation

 Cover Crops

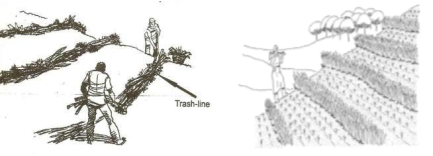
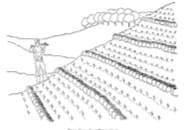
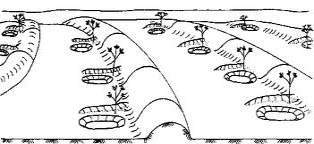
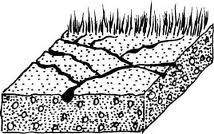
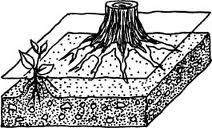
 Mulching

 Multiple cropping

 Strip cropping

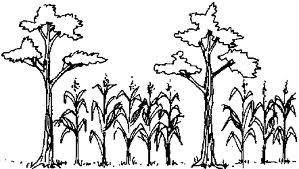
 Re-vegetation and afforestation

 Grazing land management



**Contour farming Contour bunds stone bunds**

**Terraces Trash bunds Stone bunds**



**Methods of erosion control**

**Agroforestry Mulch Intercropping**

.

**Cover crops Contour bunding**

Applicable for different landscape areas

Applicable for high slope areas e.g. Long and Seloto



**Tillage methods**

**Conservation Tillage**

• It is any tillage sequence having an objective to minimize the loss of soil and water by leaving at least 30% mulch or crop residue cover on the surface throughout the year.

• Conservation tillage aims at increasing infiltration and water retention in the root zone by reducing soil compaction and crusting.

• This practice preserves soil structure, increases soil moisture availability and reduces runoff and erosion.

**No Till Mulch tillage Ridge furrow**

**WATER** **HARVESTING** **AND** **SOIL** **MOSITURE** **RETENTION**

**Rainwater Harvesting:**

• It is defined as the collection and concentration of runoff for productive purposes (crop, fodder, pasture or tree production, livestock and domestic water supply, etc.).

• It includes all methods of collecting, concentrating, storing, using and managing runoff for productive purposes.

**Tied ridges Broad furrow Green manure**

**WATER** **HARVESTING** **AND** **SOIL** **MOSITURE** **RETENTION**

**Benefits of Rainwater Harvesting**

• Conserving the soil and water resource base

• Improving crop yields

• Improved tree seedling survival and growth rate

**Rainwater Harvesting Technologies**

**In‐situ Rainwater Conservation**

• In‐situ rainwater conservation technologies are different from runoff farming systems in that they do not include runoff generation area, but

instead aims at conserving rainfall where it falls in the cropped area or pasture.

**WATER** **HARVESTING** **AND** **SOIL** **MOSITURE** **RETENTION**

**Classification of Rainwater Harvesting**

**(RWH) Technologies and Systems**

• Runoff producing catchment

• Runoff collection (diversion and control)

structures; and

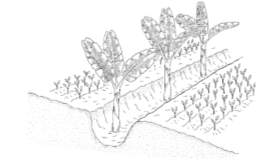
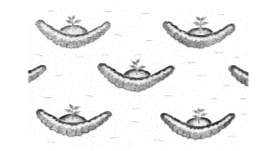
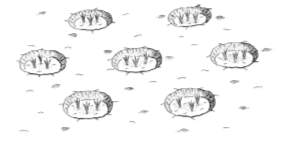
• Runoff storage facility (either soil profile in cropland or distinct structure (farm ponds, tanks, water pans, earth dams, sand dams, subsurface dams, etc).

**WATER** **HARVESTING** **AND** **SOIL** **MOSITURE** **RETENTION**

**Principle of runoff‐based rainwater harvesting technologies**

• Runoff is collected mainly from ground catchments as well as streams (flood waters) and road/footpath drainage.

• The storage is either in different structures (tanks, reservoirs, dams, water pans, etc) mainly for supplemental irrigation systems, or soil profile (for in‐situ and flood irrigation).



**WATER** **HARVESTING** **AND** **SOIL** **MOSITURE** **RETENTION**

**In‐situ Rainwater Conservation**

**In‐situ Rainwater Conservation**

• Planting Pits

• Semi‐Circular Bunds

• Earth Basins

• Retention Ditches

Planting Pits Semi-circular bunds

**Water Harvesting by External Catchment**

• Water harvesting through an external

catchment involves the transfer of runoff water

from a land area that is not cropped to

supplement the rainfall received

directly on the area where crops are grown.

Earth Basins Retention ditches



**Plant in a planting pit**



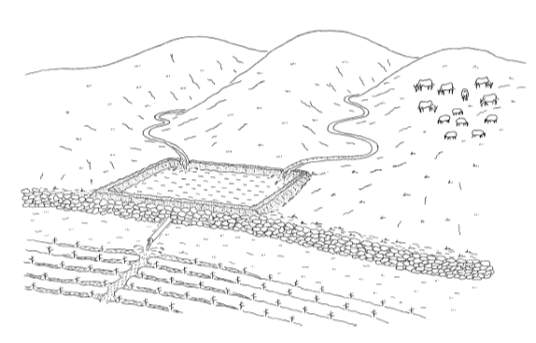
**Semi-circular bunds**

**Semi‐circular bunds**

Applicable for flat lands to increase root zone soil moisture

Applicable for areas with highly erratic rainfall with root depth restrictions

**Water harvesting by external catchment**



**Planting pits: applicable under very low moisture**



Applicable for areas with low slope positions with a good run-on catchment area

Applicable for areas with sandy soils and low fertility

**IRRIGATION**

**Purpose of irrigation**

• To supply water partially or totally for crop need

• As an insurance against drought

• To allow the movement and uptake of plant nutrients

• To leach undesirable salts in situation of salinity build up

• To control the environment of growing plants (prevent frost, cool or keep soil and plant moist).

**Irrigation as an agricultural operation helps to**

**meet plant water requirements:**

• In arid and semi‐arid areas where the soil is suitable but the rainfall amount is too low for crop production.

• Where the rainfall is sufficient in quantity but poorly distributed.

• The rainfall may be usually sufficient in quantity, and reasonably distributed, but not reliable.

**Share this with the Vegetable Group:** These irrigation options are applicable for areas with readily available water sources nonetheless they can be applied for areas where rainwater has been harvested provided it’s sufficient to meet crop demands.

**Components of irrigation systems** An irrigation system consists of:

• A water source (river, dam, well, etc)

• Distribution system (canals or pipes)

• Field application system (surface, sprinkler, drip)

• Field drainage system (surface, subsurface)

**Surface irrigation**:

- In surface irrigation, water is allowed to flow by

gravity to the respective areas through canals,

furrows, basins, etc.

**Surface Irrigation**

• Considerable loss of water occurs with this method

during conveyance due among others, to deep

percolation and evaporation.

– Surface irrigation is entirely practiced where water is abundant

– Low initial cost for development

– High labour availability for water application

**Problems:**

– Deep percolation

– Runoff

– Drainage of excess water



**Farmer field in Seloto area with off season vegetables as a result of irrigation practices**

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**IRRIGATION**



**Types of surface irrigation**

**1. Basin irrigation**

Basin irrigation consists of running water into a level area surrounded by a bank

**2. Border irrigation**

Controlled surface flooding whereby the field is divided up into strips by parallel ridges or dykes and each strip is irrigated separately by introducing water upstream and it

progressively covers the entire strip. **Basin irrigation**

**IRRIGATION**



**3. Furrow irrigation**

In furrow irrigation, only a part of the land surface (the furrow) is wetted thus minimizing evaporation loss. Irrigation is done by corrugation using small irrigation streams.

**Furrow irrigation**

**A farmer practicing Furrow Irrigation Using Bucket**

**Sprinkler** **Irrigation**

• This system consists of a network of pipes and special delivery outlets known as sprinklers to apply water to the crops, simulating rainfall.



• The pipes convey water to the nozzles of the sprinklers at different points in the field.

• The pressure head of water is converted to velocity head and the water flows out of the nozzle in the form of jet and breaks down into drops of water which wet the area within a certain range.

**Sprinkler irrigation system Farmer practicing sprinkler irrigation**



**Drip** **Irrigation**



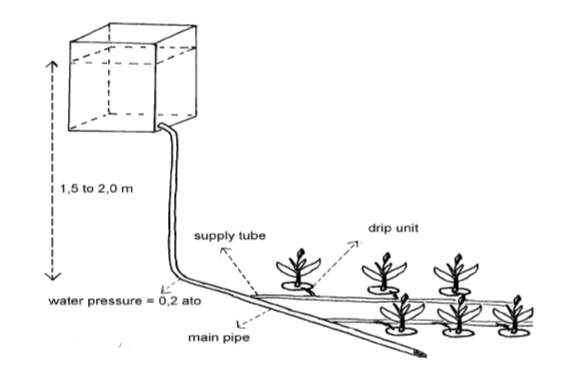
• Drip irrigation is practiced in dry, arid regions where water is scarce and must be used sparingly

• The principle of drip irrigation is to wet dry ground with small amounts of water just where the plants can absorb it.

**Farmer irrigating seedlings**

**by the aid of a watering can**

**Drip Irrigation System (Schematic) Setup of a drip irrigation system**



**How** **much** **to** **apply**

If the decision is to irrigate when available moisture is down to 50%, enough water should be added to bring it back to the FC for the depth

**When** **to** **Irrigate**

• When to irrigate depends on the stage of

crop growth as well as soil moisture.

• Frequent watering is desirable during

germination and very early stages of growth.

• Avoid stress due to shortage of moisture

at flowering and when fruit or seed is swelling.